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Blood lead level in lactating cows

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ABSTRACT

Lead is an environmental pollutant which does not only affects human but animals as well. Lead poisoning is the common cause of toxicity in cattle and advancing due to industrialisation. Lead toxicity in cows is an economic loss and also food safety issue in terms of milk, dairy products and meat. Thus, there should be a constant checking on the concentration of lead in cattle. There has, however been little research concerning lead exposure in cattle in India. The objective of this study was to detect the level of lead in cows in Bangalore, India. 15 blood samples from cows were collected in 4 different areas namely Kalenagrahara, Gottigere, Basavanapura and Kalkere in Bannerghatta and analysed using Lead Analyser(Lead Care II). Fodder and water sample were also analysed by X Ray Fluorescence and Atomic Absorption Spectroscopy respectively in order to find out the possible source of lead. Blood lead levels in cows from all the 4 areas (below 4.7 µg/dL) were within the accepted limits. Fodder and water levels of lead ranged below 45 ppm and 0.0053 ppm respectively; and all were within the accepted levels. It is thereby concluded that level of lead in cows in has not reached an alarming level and thus does not pose a threat to animals and man

Introduction

Lead poisoning has become a health hazard which is usually a food contaminant of animal origin. Lead toxicity is a state where there is accumulation of lead inside the body [2]. There has been regulation on the level of lead but however, not much lead is too much lead for the body as even a small amount of lead can cause long term damage affecting the body system. Bone is the major site for lead accumulation [5] as lead have a tendency to mimic calcium, thus the body fails to recognise lead. Neurological symptoms like muscle weakness, paraesthesia, headache, fatigue, gastrointestinal problems such as constipation, weight loss, anaemia have been reported [6]. It is a common cause in cattle as they lick what all they can find on the soil out of curiosity. Sources of lead in cattle include chewing on lead batteries, drinking water which is contaminated from lead pipes, in junk piles in pastures [1].The lead in these materials settles in the stomach of cattle, where stomach acids gradually change the lead into poisonous salts.It can lead to sterility, miscarriage and fatal death. Calves are the most vulnerable [7] as they are more likely to be contaminated if the blood of the mother and lactating milk is contaminated with lead. A single battery left in a field can poison 10 to 20 calves [3].

Milk and dairy products are important components in the human food web [4]. The presence of lead in the food chain is the result of environmental pollution and their concentrations have to be controlled on a regular basis. There has been no regulation amended for blood lead level in cattle in India.

Bannerghatta Road is a developing urban connecting many areas and it is endowed with lot of small to large factories dealing with metal works, construction works, printing factories which thereby pose a risk of contaminating the environment with heavy metal. It was therefore the objective of this study to investigate the level of lead residues in blood of cows as well as in fodder and water. 4 areas namely: Kalenagrahara , Gottigere, Basawanapura and Kalkere were selected due to the presence of polluted lake where cows would be grazing nearby, a recently constructed highway and printing factories.

Materials and methods:

Dairy cow

The dairy cattle used in this study were of jersey, Gir and red Sindhi breeds. Samples were taken from mature dairy cows above 4 years weighing between 250-400kg belonging to smallholder farmers who compiled with our request to use their animals.

Sample collection:

Blood samples-

About 10ml blood sample was taken from jugular vein using 20ml heparinised vacuum tubes under the supervision of a practised veterinary doctor. The tubes with blood were preserved in ice packed box from the field and immediately transported to the laboratory for analysis

Water and fodder sample-

Water samples were collected from the 4 areas. 4 water samples were collected which were kept in a sterilized plastic bottle. The lead content in water samples was estimated by Atomic Absorption Spectroscopy Graphite Furnace.

A total of 7 fodder sample was collected in a clean polythene bag, and then transported to the laboratory, ground in mortar to obtain in a powder form for analysis using X-Ray fluorescence spectroscopy.

Equipment's:

- XRF- x-ray fluorescence spectrophotometer (INNOV-X Systems): XRF is an analytical method to determine the chemical composition of all kinds of materials. The materials can be in solid, liquid, powder, filtered or other form. XRF can also be used to determine the thickness and composition of layers and coatings.
- Lead Analyzer (Lead care II):The lead care II blood lead analyser uses electrochemical process that detects and measure level of lead in blood sample.

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Result and discussion:

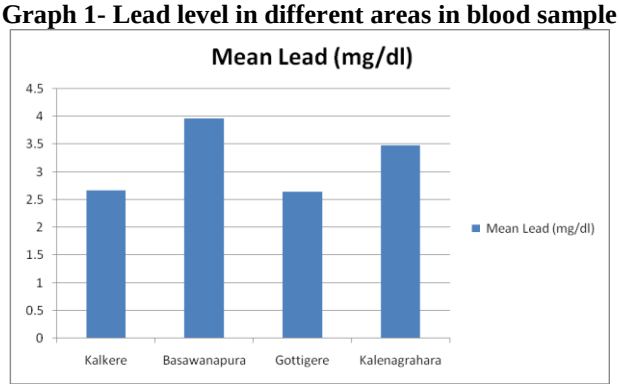
Level of lead in blood:

Indicated in Table 1 are the mean values of the 4 different areas. Blood sample from Basawanapura showed a significantly higher lead level (n=3.97 mg/dl) compared to Gottigere which has the least lead value (n=2.65 mg/dl)

Table 1. Mean value table for lead in blood sample

Area	No of Sample(n)	Mean Lead (mg/dl)
Kalkere	3	2.67
Basawanapura	3	3.97
Gottigere	4	2.65
Kalenagrahara	5	3.48

Graph 1- Lead level in different areas in blood sample



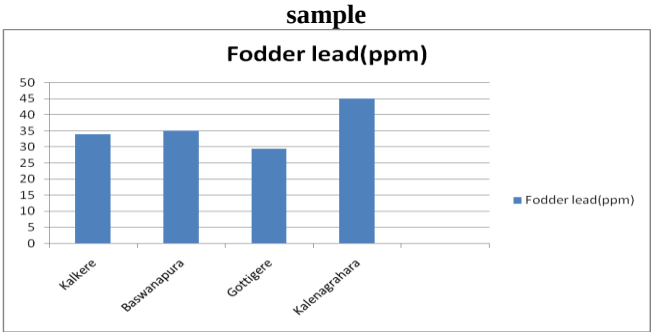
Lead level in fodder:

The fodder collected in 4 different areas in the study area had mean lead levels of 34, 35, 29.5 and 45 ppm respectively. Fodder sample taken from Kalenagrahara had the highest lead level.

Table 2. Mean value table for lead in fodder

Area	No of samples	Mean lead (ppm)
Kalkere	2	34
Basawanapura	2	35
Gottigere	2	29.5
Kalenagrahara	1	45

Graph 2. Lead level found in different areas in fodder sample



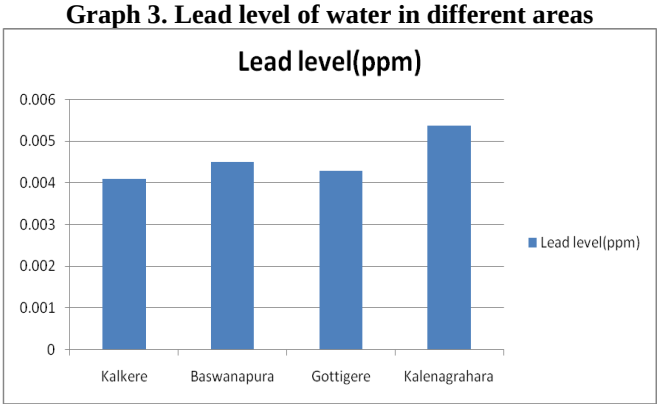
Lead level in water:

Table 3 indicates the level of lead in water used by cattle. In all the sampled areas, the water had negligible amount of lead that ranged between 0.0045-0.0053 ppm.

Table 3 - Mean value for water sample

Area	Value in ppm
Kalkere	0.0053
Basawanapura	0.0048
Gottigere	0.0045
Kalenagrahara	0.0049

Graph 3. Lead level of water in different areas



Conclusions:

In this study, all the blood samples had a low lead level i.e. below 4.7 µg/dL. However, there has been no regulation which has been set up as far as the lead acceptance level in cattles is concerned in India. Under the Australian regulation, out of 15 samples; 2 of which had lead levels exceeding the maximum acceptance level i.e. 4 µg/dL. In the area of Basawanapura, it has a mean blood lead value close to the maximum blood lead level (n=3.97). The areas of Kalkere and Gottigere have the lowest mean blood lead values where n= 2.67 and n= 2.65 respectively.

In the analysis of fodder, it was observed that low lead levels based on the Egyptian Food Standard where the maximum lead level in cattle food is 50ppm. Noteworthy, the Joint Food and Agriculture Organization(FAO) and the WHO Expert Committee on Food additives(JECFA) did not set up a tolerable intake level for dietary exposure to lead in animals since it is not possible to identify a threshold for some of its adverse effect. In most cases of cattles, it is also difficult to find out the source of the lead intake.

Similarly, analysis of lead in water in all the 4 areas had low amount of lead ie below 0.01ppm set by the National accrediation Board for Testing and Calibration, India.

The blood levels of the cows do not correlate with the data obtained from the fodder and water for the possible reason that the intake of lead were due to the grazing in polluted areas and lake.

Despite the presence of potential sources of environmental contaminants containing lead, the level of this metal in the blood of cattle, pastures and water in the 4 areas have not reached the alarming level. But however, there should be continuous monitoring.

Acknowledgements:

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